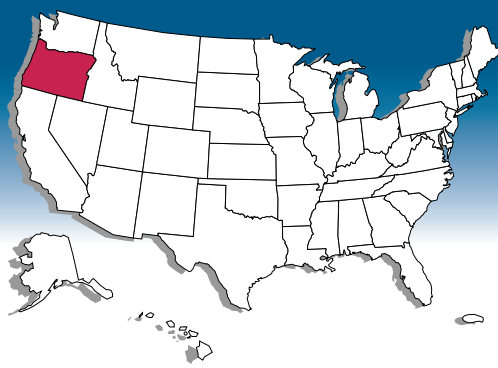
U.S. Geological Survey Programs in Oregon

U.S. Department of the Interior ■ U.S. Geological Survey



The U.S. Geological Survey (USGS) has served as the Nation's principal collector, repository, and interpreter of Earth-science data for more than a century. In this capacity, the USGS in Oregon works in partnership with State, county, and local agencies; and with other Federal agencies. Where State, county and local agencies are involved, activities typically are funded on a matching cooperative basis. This Fact Sheet describes some of the current activities in Oregon.

Earthquake and Giant Seawave Potential

USGS scientists and colleagues from the Oregon Department of Geology and Mineral Industries (DOGAMI), the academic community, and the private sector have recently changed the field of earthquake hazards assessments in Oregon. Geologists who were studying mud and sand deposits in coastal marshes from Coos Bay to Astoria found evidence that great earthquakes of magnitude 8 to perhaps 9 have occurred along the outer coast. The geologic record shows that the last event was about 300 years ago and that these great earthquakes occur about every 400 to 600 years.

Unusually large seawaves called tsunamis sweep along the coast as well, adding to the ground shaking and ground failure hazards associated with great earthquakes. These events in the recent geologic record contrast sharply with the relatively short, seismically quiet history of the past 150 years in western Oregon. The potential for future subduction earthquakes helped convince Oregon building code officials in 1994 to strengthen the seismic provisions that guide building design.

The search for earthquake sources in the Pacific Northwest has moved into the heavily populated urban corridor from Eugene, Oregon, to Vancouver, British Columbia. Scientists are concentrating on determining earthquake hazards from shallow faults by focusing in the urban areas where they could potentially cause much damage and loss of life. In the Portland area, geophysical studies indicate that the Portland Hills Fault, which crosses the city's core, is about 31 miles long. Geophysicists suspect that the Fault could produce an earthquake as large as magnitude 7; evidence of recent movement on this Fault, however, has not been found. Further studies will analyze the Fault's importance to earthquake hazards of the Portland area.

Trace Elements and Organic Compounds in Streams

Trace elements and synthetic organic compounds were detected at elevated concentrations in water, fish, and sediment in major Oregon rivers. In the lower Columbia River, dioxins and furans, pesticides, and PCB's have been detected at high concentrations in tissues of fish, otters, mink, and other wildlife. In the lower Willamette River, fish with skeletal deformities have raised concerns about contaminants, which can originate from nonpoint sources, such as runoff from agricultural and urban areas, and point sources, such as pulp and paper mills, metal-refining mills, and sewage-treatment plants.

In 1990, studies of the lower Columbia River (fig. 1) were initiated to measure trace elements and pesticides at extremely low concentrations—an important benefit to State agencies. Arsenic, which is a human carcinogen, was detected in most samples from the lower Columbia River at concentrations that exceed U.S. Environmental Protection Agency (USEPA) ambient water-quality criteria for the protection of human health and advisories for drinking water. Twenty organic pesticides also were detected, although none exceeded water-quality criteria or drinking-water guidelines.

Index of Subjects

The Willamette Basin studies (fig. 1), which include the USGS National Water-Quality Assessment Program and a cooperative project with the Oregon Department of Environmental Quality (ODEQ), are designed to define the relation of trace elements and synthetic organic compounds in water, streambed sediment, and aquatic tis-

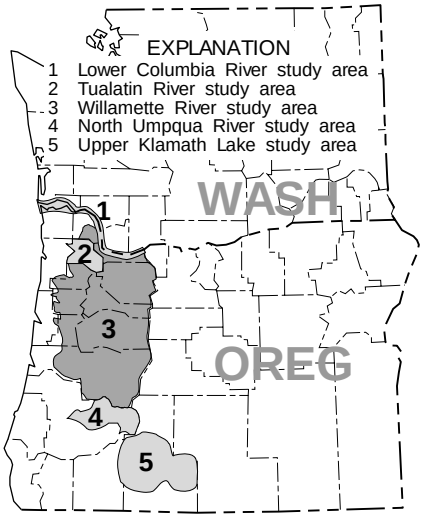


Figure 1. Locations of recent and ongoing water-quality studies.

sue to land use activities. Atrazine was the most commonly detected pesticide in water, with concentrations that sometimes exceeded the USEPA drinking-water standard in streams that drain small, intensively farmed watersheds. In contrast, atrazine concentrations at the mouth of the Willamette River were typically from 100 to 1,000 times lower than samples from agricultural basins. Dioxins and furans were detected in streambed sediments and aquatic-tissue samples throughout the Basin, but the highest concentrations were downstream from point sources.

Nonpoint Sources of Nutrients in Streams and Lakes

Phosphorous and nitrogen are nutrients that can cause excessive algal growth and ammonia toxicity in streams and lakes. In south-central Oregon (fig. 1), the USGS and the Bureau of Reclamation studies of nutrient sources to Upper Klamath Lake have indicated that overly abundant algal growth, which occurred from mid-May to late October, has likely contributed to the decline and endangerment of fish like the Lost River sucker and the shortnose sucker.

Regulations and improved methods to treat point-source sewage effluent have reduced nutrient loads to Oregon's streams and lakes, but such improvements in water quality are not always adequate. Some nonpoint sources recognized as substantial contributors of nutrients include agricultural area runoff, animal feed operations, urban runoff, and timber harvest areas. Ground water is a source of large nutrient concentrations in some areas of Oregon.

Large inputs of phosphorous to the Tualatin River (fig. 1) have created water-quality problems, such as excessive algal growth, which contributes to fluctuations in dissolved-oxygen concentrations and excessively high pH. Although remediation by controlling point sources of phosphorous has been very successful, nonpoint sources are now the major contributor in the Tualatin River Basin and apparently supply sufficient phosphorous to support algal blooms in the River.

The USGS and the Unified Sewerage Agency of Washington County determined that most nonpoint-source phosphorus that enters the Tualatin River during critical summer months is derived from ground water that is naturally enriched in phosphorous. Planners for this and other rivers now may evaluate the ground-water contribution to ensure that appropriate procedures can be recommended for farmers, foresters, and so forth in the Basin.

Geologic Mapping

The STATEMAP Component of the National Cooperative Geologic Mapping Program funds important geologic mapping in Oregon. Significant societal problems addressed by geologic mapping in several parts of the State include delineation of natural gas resources, endangered salmon ecosystem management, groundwater and landslide problems, and engineering problems related to surface faulting.

Stream-Temperature and Dissolved-Oxygen Concerns

Elevated stream temperatures caused by human activities and related low concentrations of dissolved oxygen in water can adversely affect the health of fish and aquatic ecosystems. The ODEQ administers the dissolved-oxygen standards for lakes and rivers. Development and implementation of new standards require understanding cause-and-effect relations to employ proper remediation strategies, knowledge of the frequency and timing of violations for compliance monitoring, and calibration of stream water-temperature models for testing management alternatives.

The USGS provides information to resource managers that is useful for establishing standards, remediation strategies, and management alternatives. For example, violations of State standards for dissolved oxygen and pH were observed for the Coast Fork of the Willamette River. Elsewhere on the River, the location and timing of changes in the concentrations of dissolved-oxygen caused by algal growth have been studied; on the lower reaches, rates of sediment oxygen demand from decayed organic matter have been determined. The information can be used in water-quality modeling required to manage the Willamette River.

Ongoing studies of the Tualatin River (fig. 1) help evaluate new, more-stringent water-temperature standards and provide data to determine relations between elevated river water temperatures and human-caused factors, such as removal of riparian vegetation, urban runoff, and discharge of warm effluent from wastewater-treatment plants. A simulation model of the River will help resource managers predict water temperatures when implementing management alternatives that reduce phosphorus concentrations and decrease the time-of-travel of water in affected reaches.

Ground Water in the Middle Deschutes River Basin

Streams provide for municipal, industrial, and agricultural water needs, but many streams in the State are fully or overly allocated. Communities, therefore, increasingly use ground water for their needs. Ground water, however, sustains the flow of most streams during the dry season, and development of ground water can adversely affect the flow and quality of streams under stress. Assessment of the availability of ground water and the effects of resource development under such conditions is vital in parts of Oregon, such as the middle Deschutes River Basin, where streams, closed by law to new pumping often fall below minimum levels set by the State. The Oregon Water Resources Department (OWRD) indicated that until better information is available on the basin's ground-water resources, denial of requests for new ground-water rights may become common. The USGS and the OWRD, in cooperation with the DOGAMI and local governments, are conducting a 4-year study of the middle Deschutes Basin to help State and local officials effectively manage ground water. This information is useful to private land owners and others who need and use the resource.

Ground Water in the Willamette Valley

The rapidly growing population of the Willamette River Basin places unprecedented demands on the region's water supplies because ground water is increasingly used to meet growing needs. The USGS completed a comprehensive hydrogeologic study of the Willamette Valley (fig. 2) as part of the national Regional Aquifer Systems Analysis Program (RASA), and the resulting maps and reports are useful to homeowners, consultants, and planners.

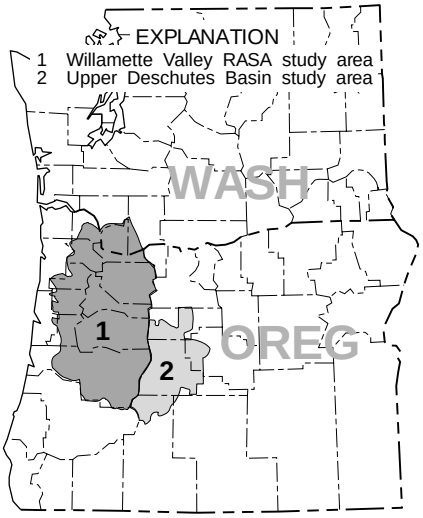


Figure 2. Locations of recent and ongoing ground-water studies. [RASA, Regional Aquifer Systems Analysis Program]

In 1995 the USGS began a cooperative study with the OWRD to develop a quantitative understanding of the ground-water hydrology in the Valley. Management issues identified by OWRD include managing ground and surface waters conjunctively, controlling long-term ground-water level declines, managing development of low-yield aquifers, and identifying areas prone to natural ground-water quality problems.

The Willamette Basin Study will evaluate the ground-water flow system to determine the timing, location, and magnitude of streamflow depletion caused by ground-water pumping; the hydrologic effects of land- and water-use policies and climate changes; the unique hydrology of basalt aquifers and their relation to water availability and management of multiple water-bearing zones; the distribution and water-bearing characteristics of low-permeability aquifers; and the origin, distribution, and chemical characteristics of naturally occurring or human-caused poor-quality ground water.

Geothermal Development and Hydrologic Monitoring

Newberry Volcano near Bend has remarkable scenic, cultural, and geologic features. To protect the area, the U.S. Congress created the Newberry National Volcanic Monument in 1990. The volcano is, however, the location of the largest potential geothermal energy resource in Oregon.

To establish baseline hydrologic and water-quality conditions before development of a proposed geothermal powerplant on the west flank of the volcano, the USGS collected data for East and Paulina Lakes, Paulina Creek, shallow ground water, and hot springs that feed each lake to evaluate possible environmental changes caused by tapping the geothermal resource. Data were collected for lake and ground-water levels, stream discharge, hot spring temperatures, and water chemistry. The cooperators included the Bonneville Power Administration, the U.S. Forest Service (USFS), and the Bureau of Land Management (BLM).

In 1994, the Oregon State Health Division found elevated concentrations of mercury in tissues of fish taken from East Lake. In 1995, the USGS mercury research laboratory in Madison, Wisconsin, which has analytical equipment needed to evaluate mercury contamination, showed that East Lake and the adjacent hot springs have dissolved-mercury concentrations that range from 25 to 50 percent of the USEPA criterion, which is above human health protective levels.

Collection of Water-Resources Data

The USGS collects and distributes basic hydrologic data that are published annually in a series entitled *Water Resources Data in Oregon*. The 1994 report contains discharge records for 201 streamflow-gaging and 45 streamflow partial-record stations, stage and content records for 32 lakes and reservoirs, and water-quality records for 47 streamflow-gaging stations and 8 ungaged stream sites. The USGS has collected water-quality data at more than 12,000 sites in Oregon.

Mineral and Environmental Evaluation of Public Lands in Southeastern Oregon

A potential of gold ores in southeastern Oregon heightened concern about the environmental impacts of mineral extractions. To help the BLM develop management plans for Federal lands in southeastern Oregon, the USGS conducted mineral-resource assessments of about 10 million acres in the Malheur, the Jordan, and the Andrews Resource Areas. In the Malheur and the Jordan areas, the project team identified significant potential for gold deposits and provided data to assess environmental hazards related to mineral development. Data can be used to assess the availability of ground water; to identify seismic, landslide, and volcanic hazards; and to prepare soils maps. The USGS cooperates with the DOGAMI, the Idaho Geological Survey, the BLM, the USFS, and the Bureau of Mines in these studies.

Topographic Mapping

Popular and versatile USGS products are 1:24,000-scale topographic maps (1 inch on the map represents 2,000 feet on the ground). Oregon is covered by 1,925 maps, which depict natural and cultural features of the landscape. The maps are longtime favorites with the general public for outdoor recreational uses and with scientists and engineers for technical applications.

Scientists and engineers need digital (computerized) base maps for research. These maps provide the geographic context for understanding the distributions and changes in spatial patterns of natural and manmade features. The USGS provides the digital cartographic data for the Nation's studies of ground water, hazards, and land and resource management.

Decisions on natural-resource issues related to forestry and fisheries in Oregon require digital data coverage of transportation networks, hydrography, boundaries, Public Land Surveys, and elevations. State and Federal agencies and local and Tribal governments provide these data for the Oregon Digital Map Library, which is operated by the State Service Center for Geographic Information Systems. The partnership helps eliminate duplication of effort and funds the completion of new data sets. Some data are free to the public, and local governments in rural areas are provided information otherwise unaffordable.

Interior Columbia Basin Ecosystem Management

The USGS provides earth science information to the Interior Columbia Basin Ecosystem Management Project (ICBEMP). The USFS and the BLM project assesses lands in the seven-State region of the east-

ern Columbia River Basin. The ICBEMP is developing regional management strategies for Federal lands in the Basin to understand the development and current state of land and water use, plants and animals, and human society within the Basin and to model future conditions for management of altered ecosystems. Strategies developed will help maintain and improve ecological health, promote processes and patterns that operate in healthy aquatic and terrestrial ecosystems, and help provide sustainable flows of resources from Federal lands.

USGS data are used by biologists, forest ecologists, sociologists, and economists; digital geologic, hydrologic, mineral-resource, and geologic process data information were contributed to the process of modeling systems and developing management alternatives. The studies help scientists understand processes that affect natural phenomena, such as erosion potential and the distributions of aquatic and terrestrial plants and animals.

Evaluating the mineral-resource potential of the Basin helps predict trends in economic development, land use, and environmental hazards. The USGS contributions help meet ICBEMP goals of restoring and sustaining ecosystem integrity and sustaining ecological and economic productivity.

Cascade Volcanoes

The USGS is responsible for identifying and monitoring volcanoes, developing new tools to assess and monitor volcano hazards, and providing information to concerned officials, agencies, and citizens. Earthquake activity beneath the Cascade volcanoes is monitored by a regional network of seismometers operated jointly by the USGS and the University of Washington.

In Oregon, a detailed geologic map of Newberry Volcano was released by the USGS in 1995, and similar studies are underway at Mount Hood and Crater Lake. Volcano-hazards assessments for each major Cascade volcano in Oregon is being updated during 1996–97. A geologic map of the entire Oregon Cascades is nearly complete. Experience at Mount St. Helens during its eruptions in the 1980's provided the basis for USGS input to land-use and emergency-response plans by Federal, State, and county agencies in Oregon and elsewhere in the Pacific Northwest.

Energy Resources of the Tyee Basin

Sedimentary rocks of the Paleogene Tyee Basin in southwestern Oregon have historically been explored for hydrocarbon energy resources, but although oil and gas seeps occur at the surface, exploratory drilling has not yet been successful. The USGS is supporting the DOGAMI by providing geologic maps of 1,500 square miles of the basin and by evaluating the region's hydrocarbon potential. The mapping has revealed the distribution of potential reservoir sandstones and new structural traps for petroleum. The studies also show that earlier explorations took place in deep-water stratigraphic sequences beyond the likely extent of potential reservoir sands at depth.

Forest and Rangeland Research

The USGS Biological Resources Division (BRD, formerly the National Biological Service) has several units in Oregon that address research issues on forests, rangelands, and contaminants in the environment.

Ongoing research at the Forest and Rangeland Ecosystem Science Center (FRESC) in Corvallis provides important information for such major initiatives as the Northwest Forest Plan, which is designed to sustain northwestern forests for economic and biological interests, and the Vegetation Diversity Project Studies, whose goals are to restore and maintain native plant diversity on rangelands in the Great Basin and the Columbia Plateau. In other studies, FRESC scientists conduct long-term limnological monitoring in Crater Lake and study the effect of environmental contaminants on wildlife populations such as osprey, river otter, mink, and colonial water birds. BRD scientists also are located at the Oregon Cooperative Fisheries Research Unit and the Oregon Cooperative Wildlife Unit, at Oregon State University in Corvallis. Fisheries Unit scientists study Oregon fish species of recreational and commercial importance. Wildlife Unit scientists study effects of contaminants, habitat alteration, and land-use conflicts on bird communities.

For More Information

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Additional earth science information can be found by accessing the USGS Home Page on the World Wide Web at **http://www.usgs.gov/**

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The **USGS** provides maps, reports, and information to help others meet their needs to manage, develop, and protect America's water, energy, mineral, biological, and land resources. We help find the natural resources needed to build tomorrow and supply the scientific understanding needed to help minimize or mitigate the effects of natural hazards and environmental damage caused by natural and human activities. The results of our efforts touch the daily life of almost every American.

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